(19) JAPANESE PATENT OFFICE (JP)

(11) Japanese Laid-Open Patent Application
(Kokai) No. 11-19076

(12) **Official Gazette for Laid-Open Patent Applications** (A)
(43) Laying-Open Date: 26 January 1999

(51) Int. Cl.[6]	Ident. Symbols	FI	
A 6 1 B 5/16		A 6 1 B 5/16	
// A 6 1 K 31/40		A 6 1 K 31/40	
35/78		35/78	C
	AAA		AAAQ
C 0 7 D 209/08		C 0 7 D 209/08	

Request for Examination: Not yet requested **Number of Inventions:** 3 FD (Total of 5 pages)

(21) **Application No.:** 9-196587

(22) **Application Date:** 7 July 1997

(71) **Applicant:** 000113470
Pola Chemical Industrial Company, Ltd.
6-48 Yayoi-cho, Shizuoka-shi, Shizuoka-ken

(72) **Inventor:** Shigeharu Tanizawa
c/o Yokohama Research Laboratories
Pola Chemical Industrial Company, Ltd.
27-1 Takashimadai, Kanagawa-ku
Yokohama-shi, Kanagawa-ken

(72) **Inventor:** Chihoko Suga
c/o Yokohama Research Laboratories
Pola Chemical Industrial Company, Ltd.
27-1 Takashimadai, Kanagawa-ku
Yokohama-shi, Kanagawa-ken

(54) **[Title of the Invention]** **A Method for the Determination of the anti-Stress Effects of Fragrances**

(57) **[Abstract]** (With Corrections)
[Problem] The problem [that this invention sets out to solve] is to provide a method for the evaluation of the anti-stress effects of fragrances in correspondence to the type of stress.

[Method of solution] A method for the determination of the anti-stress effects of fragrances is provided in which psychological stress loading is effected in the presence of a fragrance, saliva is collected before and after stress loading, quantitative determination is made of the concentration of adrenocortical hormone in the saliva and the proportion of change is used as the index. By means of this invention, the anti-stress effects of fragrances can be determined objectively.

[Claims]

[Claim 1] A method for the determination of the anti-stress effects of fragrances in which psychological stress loading is effected in the presence of a fragrance, saliva is collected before and after stress loading, quantitative determination is made of the concentration of adrenocortical hormone in the saliva and the proportion of change is used as the index.

[Claim 2] A method as described in Claim 1 in which the adrenocortical hormone is cortisol.

[Claim 3] A method of determination as described in Claims 1 or 2 in which the method of stress loading is to perform numerical calculation within a fixed period for each problem or to perform numerical calculations with a warning being issued for mistakes such as difference in calculation.

[Detailed Description of the Invention]

[0001]

[Field of industrial use] This invention relates to a method for the determination of anti-stress effects of fragrances.

[0002]

[Prior art] It has long been suggested that there are various advantages associated with the use of perfumed cosmetic products. For example, such things are said as "they make the heart feel rich," "they put the heart as ease," "they round out the personality," "they give a person grace" and "they are good for the health." However, because the effects of perfume products on the body are extremely moderate, there are very few instances of determination of the actual action of perfume products on the body in numerical terms. For example, there is a study of elevation of globulin concentrations in body fluids by the fragrance of turnips. There are essentially no instances of corroboration of other effects. Although it is generally said the fragrances act to moderate stress, the only report of a case in which these points have been corroborated scientifically is to the effect that the quantity of cortisol that is secreted in the saliva when Kraepelin tests are performed in the presence of a fragrance is less than in the absence of a fragrance. There have been no studies whatsoever of relationships to the type of stress and or relationships to the type of fragrance. That is, it can be said that at present a technique for accurately evaluating the anti-stress effects of fragrances has not been fully obtained.

[0003] It is known, of course, that hormones, of which adrenocortical hormones are representative, regulate biological reactions in the body and that they are information transmitting substances for the purpose of intermodulation of these biological reactions. Although it is known that the concentration of this type of hormone in body fluids varies as a result of stimulation such as that of fragrances, it is still not known what sort of responses to stimulation occur. Further, although it is also known that concentrations of adrenocortical hormones are increased by stress loading, the relationship between the quality of stress and the concentration of adrenocortical hormones is not known.

[0004]

[Problems the invention is intended to solve] This invention was developed on the basis of these circumstances and provides a method for the evaluation of the anti-stress effects of fragrances corresponding to the type of stress.

[0005]

[Means for solving the problems] In view of these circumstances, the inventors conducted intensive and repeated studies for the purpose of finding means for scientific corroboration of the action of

perfume products, of which the effects of fragrances are representative, on life activities. As a result, this invention was perfected by discovering that the anti-stress effects of fragrances in the presence of psychological stress can be corroborated using changes in hormone levels in body fluids as the indicator. We shall now describe this invention in detail.

[0006] (1) Method of evaluation of this invention
In the method of evaluation of this invention, body fluids are collected before and after psychological stress loading in the presence of fragrances, quantitative determinations are made of hormones in body fluids and the anti-stress effect of the hormone is evaluated on the basis of changes in the hormone. The body fluids that can be used are blood, saliva and urine. However, because there is little effect on the subject and samples can be collected periodically at any desired time, the use of saliva is best. The next best method is collection of blood using an indwelling needle. However, a sufficient time is necessary after insertion of the needle. Adrenocortical hormones are desirable because they are highly related to stress. Of these, it is preferable to use cortisol as the indicator because quantitative determinations of it can be performed easily and it is found in higher concentrations than other adrenocortical hormones. There are no particular limitations on the method of quantitative determination as long as it is a method whereby determinations can be made to low concentrations. For example, the sandwich antibody method, the fluorescence labeled antibody method or the radioimmunoassay method can be used. Of these, the radioimmunoassay method is the most desirable because of its extremely high sensitivity. It has been suggested that adrenocortical hormones are highly related to stress. The inventors discovered that there is a close relationship between cortisol in saliva and stress as described subsequently. The action of fragrances on stress is evaluated scientifically by the method of evaluation of this invention.

[0007] (2) The relationship between load of psychological stress and cortisol
The following experiment was performed in order to ascertain the relationship between load of psychological stress and cortisol. Specifically, twenty subjects were assembled and they were asked to perform two-digit addition, subtraction, multiplication and division calculations with four seconds allowed for each problem. When they could not answer within the allowed time or when they made an error in calculation, they were warned with a buzzer sound. This procedure was carried out for 30 minutes. Saliva was collected before and after this 30 minute period and the concentration of cortisol in the saliva was found by radioimmunoassay as indicated in the mode of execution of this invention to be described subsequently. The ratio of increase of cortisol in the saliva was found by the formula, (concentration of cortisol before calculation)*[sic] 100. Values were found on separate days when the allowance time was shortened to 3 seconds and when a period of 40 minutes was alotted for solving the problems. The results are shown in Table 1. From this table, it can be seen that the ratio of increase of cortisol rose in proportion to the load of psychological stress.

[0008]

[Table 1]

Conditions	Average ratio of increase of cortisol (%)
Allowance of 4 seconds, 30 minutes	43
Allowance of 3 seconds, 30 minutes	62
Allowance of 4 sec nds, 40 minutes	56

[0009] When similar experiments were performed without presenting a warning with the buzzer sound, the results shown in Table 2 were obtained. From the table, it can be seen that the concentrations of cortisol did not increase as much as shown in Table 1. It was concluded that

cortisol does not increase solely because of calculation load. That is, it can be concluded that there is a close cause-and-effect relationship between increase of cortisol and psychological stress.

[0010]
[Table 2]

Conditions	Average ratio of increase of cortisol (%)
Allowance of 4 seconds, 30 minutes	11
Allowance of 3 seconds, 30 minutes	17
Allowance of 4 seconds, 40 minutes	13

[0011] A similar study was attempted using the Kraepelin test. The results are shown in Table 3. It was found that there was little psychological stress on the Kraepelin test.

[0012]
[Table 3]

Conditions	Average ratio of increase of cortisol (%)
30 minutes	9
45 minutes	10
60 minutes	10

[0013]
[Mode of execution of the invention] The mode of execution of this invention is comprised of the steps indicated below. Specifically, it is comprised of the following four steps.

(Step 1) The subjects are kept at ease and saliva is collected.
(Step 2) They are subjected to psychological stress load without presenting a fragrance.
(Step 3) Saliva is collected.
(Step 4) The cortisol concentration in the saliva is determined by the radioimmunoassay method and the ratio of increase of cortisol is calculated.

The steps are varied as follows and evaluations of fragrance are made. Specifically, it is comprised of the following five steps.

(Step 1') The subjects are subjected to psychological stress.
(Step 2') Saliva is collected.
(Step 3') Fragrance is presented.
(Step 4') Saliva is collected.
(Step 5') Quantitative determination is made of the cortisol concentration in the saliva and the ratio of change in cortisol is calculated. Fragrance is evaluated on the basis of the change in the ratio of change over time.

We shall now describe these steps in detail.

[0014] (Step 1). At this stage, care must be taken to collect the saliva without putting a load on the subjects and collection must be performed naturally. After the subjects have entered the laboratory, music should be played and there must be a waiting period so that cortisol concentrations in the saliva will be at normal levels.

[0015] (Step 2). A desirable method is to induce high levels of psychological stress by physical stress. For example, the psychological stress of card games and a color reading process with a warning in which the subject is required to read the names of colors and state the names of colors in a table in which the colors are identified by color names different from their actual color names with the subject being warned with a buzzer sound when a mistake is made is employed. The preferable method is calculation load with a warning. Because this provides a high level of psychological stress load, the effect of the fragrance can be determined more accurately. The fragrance is presented immediately before this procedure. Presentation of the fragrance should be unobtrusive but to an extent at which it can be perceived. Specifically, on the order of $0.01 \sim 1$ mg/m^3 is desirable. There are no particular limitations on the method of presentation as long as it is an ordinary method; for example, methods using spraying and natural transpiration through the agency of volatilization promoting media such as fine thread wicks. Of these, spraying methods are preferable. In this step, care should be taken that the fragrance not be extinguished during the period of psychological stress loading.

[0016] (Step 3). In the collection of saliva, care must be taken so that the collection of saliva does not cause psychological stress. That is, it should be collected in as natural a way as possible. A tube may be left in the mouth so that the saliva can be suctioned off slowly. It is essential that the quantity collected be 0.3 to 0.6 ml.

[017] (Step 4). Determination of cortisol in the saliva may be performed by ordinary methods and may include methods using labeled antibodies and radioimmunoassay. From the standpoint of sensitivity, methods based on radioimmunoassay are preferable. There are commercial kits and they may be used. A kit of this type is, for example, Gamma Coro Cortisol [phonetic]* , manufactured by the Baxter [phonetic] Company.

[18] The variations on the method in Step 1' to Step 5' may also be performed in accordance with these procedures.

[19]
[Examples]
Example 1
Cortisol decreasing action of fragrances

Twenty test subjects were subjected to the four second allowance 30-minute calculation load described above for 30 minutes in the presence of lavender, mint and skatole fragrances. After the procedure was completed, the degree to which the subjects experienced calmness in the presence of the respective fragrances was scored, with a score of 10 points indicating a feeling of calmness to an extremely great extent, a score of 0 indicating no feeling of calmness whatsoever, and a score of 1-10 indicating disturbance of calmness. In the control group, the procedure was performed without presenting fragrances. Saliva was collected before and after the procedure and quantitative determinations were made of cortisol using Gamma Cort Cortisol. Specifically, the saliva was frozen at -20°C for 24 hours and was then restored to 5°C. It was centrifuged for 15 minutes at 3000 cpm and the supernatant was collected. The supernatant was stored at -20°C until immediately before determination. One vial of the tracer solution in the kit was thoroughly mixed with 100 ml of the buffer solution in the kit to make a tracer buffer solution. Amounts of 200 μl each of physiological saline solution as the blank and cortisol standard solution were introduced into the antibody tubes.

* Translator's Note: Transliterated phonetically from the Japanese. As such, the spelling may differ from other transliterations.

Amounts of 1 ml each of tracer buffer solution were added to the tubes (T1 and T2) for use in total count determinations; caps were placed on the tubes and they were designated as total count tubes. These tubes were incubated at 37°C for 45 minutes. The solutions in them were removed and the radioactivity of all of the tubes was determined with a gamma ray counter. The radioactivity for the standard solution was plotted, a calibration curve was prepared and the concentration of cortisol in each sample was calculated from the calibration curve. The results are shown in Table 4. From this table, it can be seen that the concentrations of cortisol in the saliva were significantly decreased with mint and lavender. With skatole, the concentration of cortisol was somewhat elevated. These findings were well correlated with the order of calmness experienced by the panel.

[0020]
[Table 4]

Sample	Before Stress (μg/dl)	After Stress (μg/dl)	Average Score
Control	0.240	0.351	
Lavender	0.247	0.312	5.4
Mint	0.250	0.294	7.1
Skatole	0.248	0.376	-5.3

[021] Example 2

Application of stress was effected by giving the subjects a table in which color names were described as colors different from the actual color names. In the first 15 minutes, they were asked to recite the names of the colors. In the final 15 minutes, they were asked to recite the names of the colors and were warned with a buzzer sound when they made a mistake. The changes in cortisol in the saliva were observed in the same way as in Example 1. The results are shown in Table 5. It was found that the anti-stress effects of fragrances on the application of stress in this way could be determined, although the stress was not as great as when calculations were performed with a warning as described above.

[0022]
[Table 5]

Sample	Before Stress (μg/dl)	After Stress (μd/dl)
Control	0.245	0.350
Lavender	0.241	0.309
Mint	0.239	0.286
Skatole	0.232	0.363

[0023] Reference Example

Stress application was changed to the Kraepelin test and changes in cortisol in the saliva were observed in the same way as in Examples 1 and 2. The results are shown in Table 6. With the Kraepelin test, the effects were not as great as in Examples 1 and 2. This is because there is little psychological stress in the Kraepelin test. Consequently, the stress application method of this invention is more suitable than the Kraepelin test for determination of the anti-stress effects of fragrances.

[0024]
[Table 6]

Sample	After Stress (μg/dl)	Average Score (μg/dl)
Control	0.242	0.275
Lavender	0.233	0.251
Mint	0.244	0.264
Skatole	0.239	0.296

[025]
[Effect of the invention] Anti-stress effects of fragrances can be determined objectively by means of this invention.

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平1－119076

⑤Int.Cl.⁴	識別記号	庁内整理番号
H 01 L 39/24	ZAA	F－8728－5F
C 01 B 13/14	ZAA	Z－6939－4G
C 04 B 41/80	ZAA	A－7412－4G
H 01 B 13/00	HCU	Z－8832－5E
H 01 L 21/88	ZAA	M－6708－5F
// H 01 B 12/06	ZAA	8623－5E

⑬公開　平成1年(1989)5月11日

審査請求　未請求　発明の数 1　(全4頁)

⑭発明の名称　酸化物超伝導体膜の製造方法

⑳特　願　昭62－276393

㉒出　願　昭62(1987)10月30日

㉗発明者　相崎　尚昭　東京都港区芝5丁目33番1号　日本電気株式会社内

㉑出願人　日本電気株式会社　東京都港区芝5丁目33番1号

㉔代理人　弁理士　内原　晋

明細書

発明の名称　酸化物超伝導体膜の製造方法

特許請求の範囲

基板上に被着した酸化物超伝導体膜の上に全面あるいは部分的に反射率調整膜を被着させて、大気中または酸素を含む雰囲気中で加熱した後、大気中または酸素を含む雰囲気中で基板を加熱したままでレーザビームを照射し、基板もしくはレーザビームを走査することによって前記酸化物超伝導体膜を順次溶融、冷却し、再結晶化して前記酸化物超伝導体膜を高温超伝導化することを特徴とする酸化物超伝導体膜の製造方法。

発明の詳細な説明

(産業上の利用分野)

本発明は酸化物超伝導体膜の製造方法に関し、特にエレクトロニクスへの応用に重要な低温での薄膜の製造方法に関するものである。

(従来の技術)

酸化物超伝導体をエレクトロニクス分野に応用するためには、薄膜化が不可欠である。現在までに、真空蒸着法やスパッタ法を用いて酸化物超伝導体膜をマグネシア(MgO)やサファイヤ(Al_2O_3)基板上に1μm程度被着し(第2図(a))、引き続き酸素雰囲気中900~950℃で数時間熱処理することにより、液体窒素温度(77K)以上の高い超伝導転移温度を示す薄膜が得られている(第2図(b))。

しかしながら、以上述べた方法では、900~950℃という高温で数時間という長時間の熱処理を必要とするので、半導体回路の配線等に応用した場合にはすでに形成されている素子の特性を劣化させてしまうという問題点があった。

(発明が解決しようとする問題点)

こうした高温かつ長時間の熱処理が必要という従来技術の問題点を解決する手段として、基板上に被着した酸化物超伝導体膜をレーザビームで照射し、基板もしくはレーザビームを走査することによって前記酸化物超伝導体膜を順次溶融、冷却し、再結晶化して前記酸化物超伝導体膜を高温超

伝導化する方法が考えられる。その場合には、基板上に被着した酸化物超伝導体膜のみが極めて短時間高温になるので基板にすでに形成されている素子の特性を劣化させることはない。また、レーザビームで局所的に加熱された後の熱的環境がいずれの位置においても同等であるためには、一定の膜厚で、かつ、全面に酸化物超伝導体膜が被着されていることが必要である。

この方法によれば、基板全面に被着された酸化物超伝導体膜の一部分のみに選択的に高温超伝導性を付与するにはレーザビームの照射を該当する部分のみ行えば良い。しかしながら、通常、レーザビームの直径は10μm以上であり、数μm以下の微細なパターンに従って部分的に高温超伝導性を付与することは困難であるという問題点がある。

本発明の目的は、このような従来技術の欠点を取り除いた酸化物超伝導体膜の製造方法を提供することにある。

(問題点を解決するための手段)

本発明は、基板上に被着した酸化物超伝導体膜の上に全面あるいは部分的に反射率調整膜を被着させて、大気中または酸素を含む雰囲気中で加熱した後、大気中または酸素を含む雰囲気中で基板を加熱したままでレーザビームを照射し、基板もしくはレーザビームを走査することによって前記酸化物超伝導体膜を順次溶融、冷却し、再結晶化して前記酸化物超伝導体膜を高温超伝導化することを特徴とする酸化物超伝導体膜の製造方法である。

(作用)

本発明では、基板上に被着した酸化物超伝導体膜の上に全面あるいは部分的に反射率調整膜を被着させてレーザビームで走査しながら、ビーム照射部を溶融再結晶化する。したがって、微細な反射率調整膜パターンに従って部分的に高温超伝導性を付与することができる。

(実施例)

次に本発明の第一の実施例を示す。

まず、表面を2μm膜厚の酸化シリコン膜(SiO_2)12で被覆したシリコン基板(Si)11上に、Y-Ba-Cu-O系ターゲットを用いたスパッタ法により、$YBa_2Cu_3O_7$に近い組成を持つ酸化物超伝導体膜13を1μm被着する(第1図(a))。スパッタはアルゴン(Ar)と酸素(O_2)との混合ガス雰囲気中で、基板温度は室温ないし500℃で行う。さらに、この上にCVD法等により、反射率調整膜として、0.17μm膜厚の酸化シリコン膜および0.06μm膜厚の窒化シリコン膜を被着する。この段階では酸化物超伝導体膜13はアモルファスかアモルファスに近い多結晶体で超伝導性は示さない。次に、通常半導体集積回路を製造プロセスで行われているフォトリソグラフィーおよびドライエッチングにより酸化シリコン膜と窒化シリコン膜から成る反射率調整膜を所定のパターンに従ってパターニングする。次いで、酸化物超伝導体膜および反射率調整膜を被着したシリコン基板を大気中または酸素を含む雰囲気中で300℃ないし500℃にて20分以上加熱して膜中に酸素を補給しておく。さらに、大気中または酸素を雰囲気中で基板温度を300℃ないし500℃に保ったままで反射率調整膜を被着した酸化物超伝導体膜13表面にArレーザビームを照射して溶融、冷却し、再結晶化領域14を形成する(第1図(b))。酸化物超伝導体膜13面内でArレーザビームを走査することによって前記酸化物超伝導体膜を順次溶融、冷却し、再結晶化した酸化物超伝導体膜15を作製する(第1図(c))。レーザ再結晶化条件はビーム直径80ないし100μm、出力1.5ないし2.5W、走査速度10ないし60mm/secである。このとき、反射率調整膜を被着した部分ではレーザビームの反射率は10%程度であって、反射率調整膜を被着していない部分にくらべ1/4ないし1/5であるため反射率調整膜を被着した部分の酸化物超伝導体膜のみにおいて得られた酸化物超伝導体膜15が、組成がほぼ$YBa_2Cu_3O_7$で、結晶構造が規則的な酸素配列をもつ斜方晶系になるため、高温超伝導性を示し、80K以上の高い超伝導転移温度を示す。以上、実施例で示したように、本発明による方法を用いれ

ば、微細な反射率調整膜パターンに従って部分的に高温超伝導性を付与することができる。

以上、第一の実施例では、反射率調整膜として反射率調整膜がない場合にくらべ反射率が小さくなる場合について説明したが、逆に、反射率調整膜として反射率調整膜がない場合にくらべ反射率が大きくなるようにしてもよい。そのような第二の実施例について第1図(b)に示す。第1図(b)では、反射率調整膜として、1μm膜厚の酸化シリコン膜、0.15μm膜厚の多結晶シリコン膜、0.04μm膜厚の窒化シリコン膜および0.15μm膜厚の多結晶シリコン膜を被着している。この場合には、反射率調整膜を被着した部分ではレーザビームの反射率は80%程度であって、反射率調整膜を被着していない部分にくらべ2倍程度であるため、レーザ再結晶化条件として、ビーム直径80ないし100μm、出力3ないし5W、走査速度10ないし60mm/secとすれば、反射率調整膜を被着していない部分の酸化物超伝導体膜のみにおいて得られた酸化物超伝導体膜15が、組成がほぼ$YBa_2Cu_3O_7$で、結晶構造が規則的な酸素配列をもつ斜方晶系になるため、高温超伝導性を示し、80K以上の高い超伝導転移温度を示すことになる。

以上に述べた本方法は、アモルファス状のSiO_2上にも適用可能なことから、多層構造にも用いることができ、広くデバイスへの応用が期待できる。

以上に述べた実施例では、酸化物超伝導体膜にスパッタ法により被着したY-Ba-Cu-O系薄膜を用いたが、蒸着法やCVD法など他の成膜技術や、La-Sr-Cu-O系などの他の酸化物超伝導体を用いることもできる。また、基板には表面をSiO_2で被覆したSi基板を使用したが、MgOや$SrTiO_3$など他の物質でなる基板を用いてもよい。さらに、レーザビームを照射した場合の基板温度は、レーザビームのパワーなどを上げることにより、一層低温化できる。またレーザビーム照射前の加熱処理は、ここで用いた大気中または酸素を含む雰囲気中で加熱するに限らず、プラズマ中で行っても良いし必要に応じて光などを照射して効率を上げても良い。

(発明の効果)

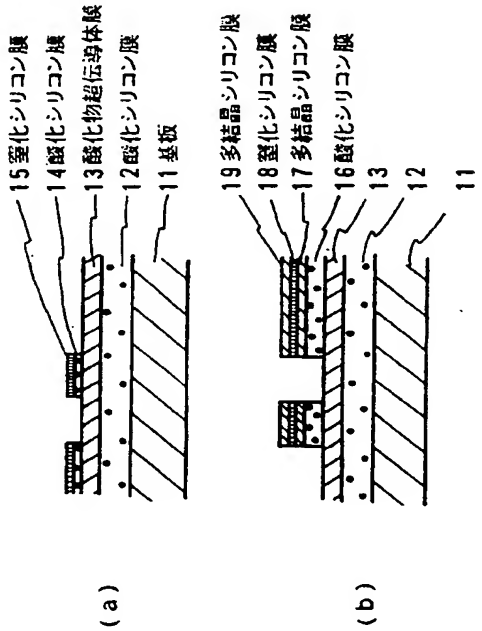
本発明によれば、基板温度は500℃以下という低温に保ったままで、熱酸化膜やスパッタ法、CVD法などで被着された通常の絶縁膜上にも高温超伝導性の酸化物超伝導体膜を作製することができ、基板内にすでに形成されている素子の特性を劣化させることがないという利点を生かしながら、かつ、微細な反射率調整膜パターンに従って部分的に高温超伝導性を付与することができる。したがって、多層かつ微細なパターンの酸化物超伝導体膜を必要とする電子デバイスへの応用が可能である。

図面の簡単な説明

第1図(a)~(b)は本発明の酸化物超伝導体膜の製造方法を示す断面図、第2図(a)~(b)は従来の酸化物超伝導体膜の製造方法を示す断面図である。

図において、11,12は基板、12,14,16は酸化シリコン膜、15,18は窒化シリコン膜、17,19は多結晶シリコン膜、13,22は酸化物超伝導体膜、23は高温超伝導性の酸化物超伝導体膜である。

第1図



第　2　図